Accumulation progress and its regulations for Jurassic-Cretaceous Petroleum System in the central Junggar Basin

Gang Liu *, Yanzhao Wei, Deyu Gong, Gang Chen, Liya Ma, Yuan Miao
Research Institute of Petroleum Exploration and Development, PetroChina, Beijing, China

1 Introduction
Altogether 6 oil and gas fields have been discovered in the Central Junggar Basin covering an area of $2.8 \times 10^4$ km$^2$, with their primary pay zones occurred in the Lower Jurassic $J_1b$ and $J_1s$ Formations, Middle Jurassic $J_2x$ and $J_2t$ Formations and the Cretaceous $K_1q$ and $K_1h$ Formations. These oil and gas accumulations are characterized as shallow burial depth (the northern part lower than 2500 m, the southern part lower than 4000 m), large reserves, easy development and high production, which makes the Central Junggar Basin a significant target for prospect of economical petroleum accumulations (Wu, et al, 2004; Tao, et al, 2008). Since Paleogene, the basin tilted to the south resulting the destruction of the existed accumulations. As a result, the accumulation progress and its regulations for current Jurassic-Cretaceous petroleum system is sophisticated with their controlling factors remaining obscure.

This article is mainly describe the accumulation progress and its regulations for Jurassic-Cretaceous petroleum.

2 Accumulation progress and regulations
After analyzing the structure evolution (Hu, et al, 2006), generation and expulsion history of source rocks (Cao, et al, 2012), reservoir-caprock assemblage, migration and preservation conditions in the Lu 9 oil reservoirs of Luliang oil field and Pencan 2 oil reservoirs of Mosuowan oil field (Xiao, et al, 2010), their petroleum accumulation processes are fully discussed. With the help of geochemical methods such as methyl-phenanthrene index, biomarkers and GC parameters, two stages of petroleum accumulations are identified in the Central Junggar Basin with are the original accumulation in the Cretaceous and the modification in the Late Paleogene.

The reconstruction of the Jurassic strata in the critical period indicates that three large uplifts were developed in the Central Junggar Basin during the Cretaceous (i.e., Muo-
suowan, Mobei-Shixi, Jidong-Luliang Uplifts), which controlled the oil migration and accumulation. Based on the inversion analysis (i.e., GOI, QGF, QGF-E, fluorescence in mud logging and gasometry logging) and the forward modeling (the relationship between the controlling factors of oil accumulation such as source rock evolution, reservoir-caprock assemblage and distribution pattern of Hercynian and Himalayan faults), it is further consolidated that the three large uplifts are significant oil accumulation targets. In the Muosuowan and Mobei-Shixi Uplifts, oil primarily accumulated in the Lower Jurassic J1s Formation. In the Jidong-Luliang Uplift, oil primarily accumulated in the Middle Jurassic J2x and J2t Formation, and Cretaceous K1q Formations.

During the Late Paleogene, the general uplift of Central Junggar Basin resulted in the destructions of Muosuowan and Shixi Paleo-uplifts. As a result, some low structures were formed at the north edge of the Paleo-uplifts and some low convex belts were formed to the further north. Thus, the paleo-oil-reservoirs were destructed and the oil remigrated to the north. After analyzing the structural characteristics, sand bodies and the distribution patterns of faults, two remigration pathways in the Jurassic J1s Formation were identified in the Mosuowan paleo-oil-reservoirs: 1) oil remigrated northward along the inheritable nasal convex belts; 2) oil remigrated northward along the inner ring belt. Two remigration pathways in the Cretaceous K1q Formation were identified in the Muobei-Shixi J1s paleo-oil-reservoirs: 1) oil remigrated northward along the eastern edge of Jidong nasal convex belt; 2) oil remigrated northward along the Shidong nasal convex belt. The Jidong-Luliang area is an inheritable uplift with its structure remained relatively stable since Paleogene. As a result, paleo-oil-reservoirs barely experienced severe destructions and original oil accumulations are the main prospect targets in this area. This area is also the main targets for the modification of paleo-oil-reservoirs.

Three favorable belts were identified in the Jurassic based on the preferable migration pathways, lithology bodies controlled by paleo-geomorphology, sheltering baffles of Himalayan faults and the recent exploration situation which are the southern Mosuowan Uplift, Mobei inner ring belt, and the northern Dabasong Uplift, primarily characterized as lithology and fault block reservoirs. Two favorable belts were identified in the Cretaceous which are the K1q and K1h Formations in the Shidong Uplift and the eastern edge of Jidong Uplift, primarily characterized as lithology and stratum reservoirs.

References


